Amer. Malac. Bull. **25**: 77-86 (2008)

Two new chitons of the genus *Tripoplax* Berry, 1919 from the Monterey Sea Canyon*

Roger N. Clark[1]

Department of Invertebrate Zoology, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, California 93105-2936, U.S.A., insignis_one@yahoo.com

Abstract: Recent deep-sea trawling in the Monterey Sea Canyon, California has brought to light two previously unknown bathyal chitons. The new species, members of the family Ischnochitonidae, are placed in the genus *Tripoplax* Berry, 1919, here in raised to full generic rank on the basis of morphological and ecological characteristics. *Tripoplax calypso* spec. nov. and *Tripoplax cowani* spec. nov. are described, illustrated, and compared to similar species from the region.

Key words: Polyplacophora, new species, mollusc, Monterey Bay

The Monterey submarine canyon is a gigantic undersea chasm, starting just offshore in less than 10 m of water, and plunging to depths of more than 3000 m just 50 km offshore. The Carmel Canyon is the southern branch of this system. The fauna of these canyons is extremely rich and diverse, and is being intensely studied by the Monterey Bay Aquarium Research Institute and the Moss Landing Marine Laboratories.

Deep-sea trawling in the canyons by the research vessels USNS *DE Steiguer* (1975) and the R/V *Point Sur* (1994-1998) have procured several specimens of two undescribed chitons of the genus *Tripoplax* Berry, 1919. *Tripoplax calypso* spec. nov. and *Tripoplax cowani* spec. nov. were taken at depths of 650-1044 m on rocks and sponges. The new species are compared to the similar *Lepidozona retiporosa* (Carpenter, 1864), *Lepidozona scrobiculata* (von Middendorff, 1847) and *Lepidozona golischi* (Berry, 1919), and *Tripoplax abyssicola* (Smith and Cowan, 1966), and *Stenosemus stearnsii* (Dall, 1902), respectively.

Both new species are members of the genus *Tripoplax* Berry, 1919, herein elevated to full generic status and characterized by fine tegmental sculpturing, relatively small girdle scales (~300 μm), and multiple slits in the insertion plates of the intermediate valves, in contrast to the genus *Lepidozona* Pilsbry, 1892 which has single-slitted intermediate valves and usually coarser (often pustulose or tuberculose) sculpturing. Additionally, all members of *Tripoplax* are cold northern or deep water inhabitants, distributed in the northern Pacific Ocean between latitudes 36°N (off central California, U.S.A.) and 37°N (northern Honshu, Japan) and 60°N in the Gulf of Alaska and Okhotsk Sea, in cool temperate to sub-arctic and bathy-abyssal waters, restricted to temperatures below about 9 °C. *Tripoplax* reaches its greatest diversity in the Aleutian Islands of Alaska, where seven species are presently known. Members of *Lepidozona* are distributed nearly worldwide, and they typically inhabit warmer, temperate to tropical waters, at depths of 400 m or less. Most inhabit shallow (1-50 m) subtidal waters. Only four species of *Lepidozona* are found in the Gulf of Alaska north of 50°N: *Lepidozona mertensii* (von Middendorff, 1847), *Lepidozona willetti* (Berry, 1917), *Lepidozona retiporosa*, and *Lepidozona golischi*. The genus is absent in the Aleutian Islands, and only the species *Lepidozona multiganosa* Sirenko, 1978 is found in the southern Okhotsk Sea, near the southern Kurile Islands, north to Urup Island (46°N). No species of *Lepidozona* occur in the north Pacific region between 152°W, east of Kodiak Island, Alaska and about 150°E, east of Urup Island, Kurile Islands, Russia.

Berry (1919) briefly defined *Tripoplax* for the Alaskan species *Ischnochiton* (*Trachydermon*) *trifidus* Carpenter, 1864, a species that Dall (1871) had erroneously placed in the subgenus *Ischnoradsia* Shuttleworth, 1853 with *Chiton anstralis* Sowerby, 1840. Realizing that these two taxa were only distantly related, Berry separated the two species because of the rather smooth tegmental sculpturing and relatively small girdle scales (to 315 × 250 μm) possessed by *I. trifidus*, in contrast with the coarse sculpture and very

[1] Mailing Address: 3808 E. Pinehurst Drive, Eagle Mountain, Utah 84005-6007, U.S.A.

* From the symposium "Advances in Chiton Research" presented at the joint meeting of the American Malacological Society and Western Society of Malacologists, held 29 July to 3 August 2006 in Seattle, Washington.

large (to 600 μm in width), subcarinated girdle scales of *I. australis*. *Ischnoradsia* is presently regarded as monotypic subgenus for *Ischnochiton australis* (Sowerby) by Kaas and Van Belle (1990). The validity of *Trachydermon* is somewhat unclear, at the time of its very brief description and subsequent usage by Carpenter; it was an assemblage of several unrelated species, presently placed in three different families, without an original type designation. Kaas and Van Belle (1985) considered it a synonym of *Lepidochitona* Gray, 1821, but that may be invalid as well, and a re-evaluation of this name, its validity, and position is clearly necessary (see Palmer 1958: 284). Kaas and Van Belle (1987) used *Tripoplax* as a subgenus of *Lepidozona* Pilsbry, 1892 for members of that genus with multiple slits in the insertion plates of the intermediate valves. This combination was followed by Clark (1991, 2000).

In its morphology and biogeography, *Tripoplax* appears to be a natural assemblage. Molecular studies would be valuable to test this hypothesis and its relationship to *Lepidozona*.

Acronyms used in the text are: CASIZ, California Academy of Sciences, Invertebrate Zoology; LACM, Los Angeles County Museum of Natural History; ZIAS, Zoological Institute, Academy of Sciences, Saint Petersburg, Russia; RNC, Roger N. Clark personal collection.

SYSTEMATICS

Class: POLYPLACOPHORA Gray, 1821
Order: Chitonida Thiele, 1909
Family: Ischnochitonidae Dall, 1889
Genus: *Tripoplax* Berry, 1919

Type species: *Ischnochiton* (*Trachydermon*) *trifidus* Carpenter, 1864, by original designation

Ischnoradsia Carpenter MS, Dall, 1871, non Shuttleworth, 1853; *Gurjanovillia* Jakovleva, 1952; *Albrechtia* I. Taki, 1955

Expanded definition

Small to medium sized chitons (1-6.5 cm), elongate-oval to broadly oval in outline; central areas with fine pitting, net-like reticulation of cross threading or finely beaded longitudinal lirae, crossed by growth lines or very fine transverse lirae. Radial areas with relatively weak or very fine sculpturing; insertion plates of intermediate valves with two to four slits. Dorsal girdle scales relatively small (200-320 μm in length), smooth, or bearing minute riblets or striations, and often mammillated at apices.

Tripoplax calypso spec. nov.
Tripoplax cowani spec. nov.

Tripoplax calypso spec. nov. (Figs. 1-7)

Diagnosis

Small (to 17 mm), oval chitons; valves carinated, slopes convex; lateral areas with three to five low, faint radial ribs separated by weak sulci; central areas with 26-28 curved, longitudinal riblets; girdle with imbicating, striated scales to 200 × 160 μm; radula with heavy, bidentate major lateral

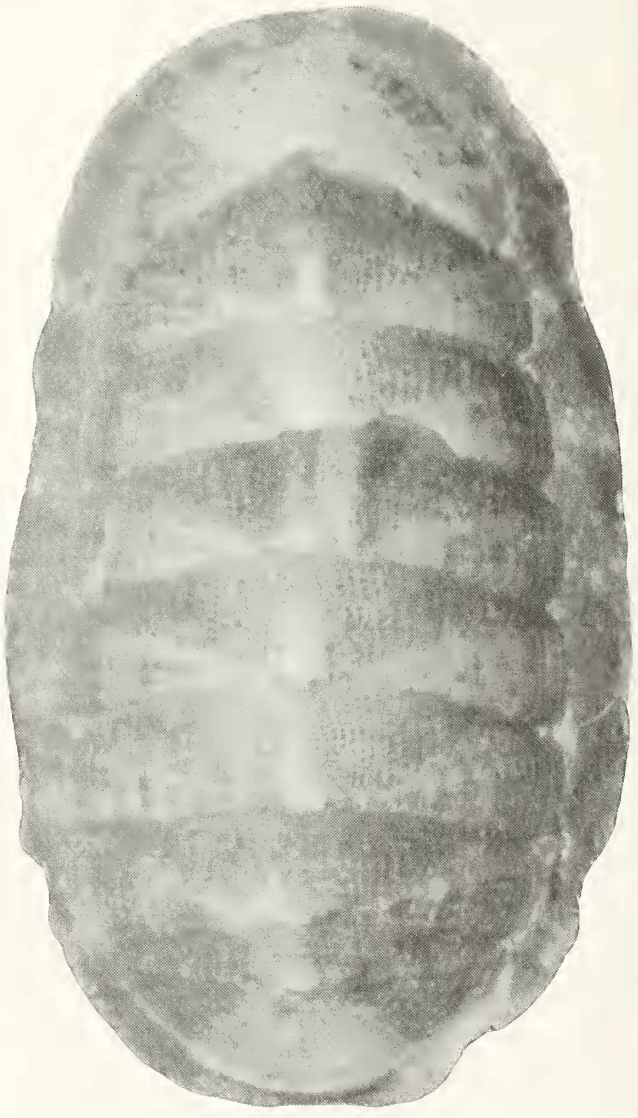

Figure 1. *Tripoplax calypso* Clark, spec. nov. Paratype (RNC 2060), scale bar = 10 mm.

teeth. Color: valves and girdle dull reddish-brown with some white patches.

Description

Holotype (Figs. 2-7) small (13.5 × 8.2 × 2.7 mm), oval, moderately elevated; valves granular, carinated, side slopes convex, tegmentum delicately sculptured. Head valve (Fig. 2) semi-circular, posterior margin widely V-shaped, bearing 23 low, faint (nearly obsolete), rounded radial ribs. Intermediate valves (Figs. 3-4) oblong, about four times as wide as long; lateral areas with three to five low, faint radial ribs, separated by faint sulci; central areas with about fourteen curved, longitudinal ribs per side, becoming obsolete at the jugum; the ribs (when viewed dorsally) are seen to be made up of faint transverse riblets with numerous raised posterior extensions, which overlap the next rib in the series, as if made up of overlapping drips; jugal areas show only obsolete pitting. Tail valve (Fig. 5) relatively large, almost diamond shaped; mucro ante-central, slightly raised; postmucronal slope concave; ante-mucronal area with obsolete pitting; terminal area with about 21 low, faint radial ribs. Articulamentum white, insertion teeth short, blunt; sutural laminae short, round, connected across the jugal sinus by a short, concave jugal plate with slits at edges; slit formula 11/2/13. Girdle narrow, about one fifth as wide as intermediate valve five; clothed dorsally with imbricating, oval, striated scales (Fig. 6) to about 200 × 160 μm, and bearing 15-16 rather weak riblets; margin of girdle with minute, pointed spicules to 60 × 18 μm; ventral surface of girdle with radiating rows of minute, rectangular scales to 100 × 15 μm. Radula (Fig. 7) 6.0 mm long, bearing 40 mature rows of teeth; rachidean tooth hourglass shaped, working edge about 50 μm wide; minor lateral teeth wing-shaped, with small, lateral extension near the anterolateral edge; major laterals relatively large, with bidentate denticle cap, the inner cusp about twice as long as outer cusp. Ctenidia holobranchial, adanal about 17 per side. Color: dull reddish-brown with white patches on terminal valves, and jugal areas of some intermediate valves. Paratype (Fig. 1) agrees with holotype in all aspects, but is larger (17.0 mm × 10.0 mm × 3.1 mm), and has 18 ctenidia per side.

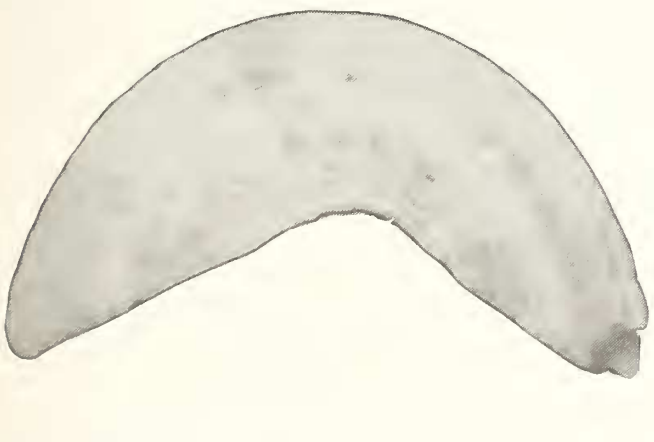

Figure 2. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Head valve, scale bar = 5 mm.

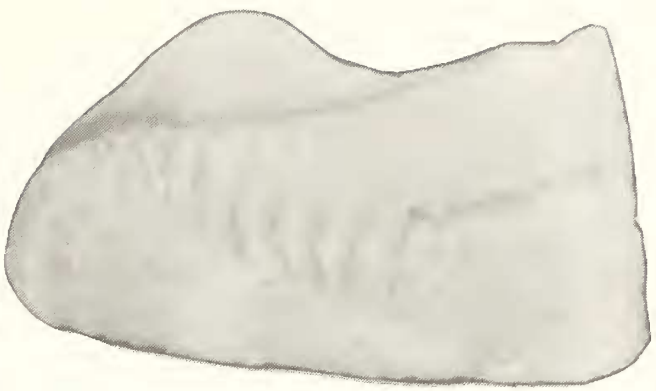

Figure 3. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Intermediate valve fragments, scale bar = 5 mm.

Figure 4. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Intermediate valve fragments, scale bar = 5 mm. SEM image.

Type material: Holotype (LACM 2882); radula, girdle, and intermediate valve fragment mounted on SEM

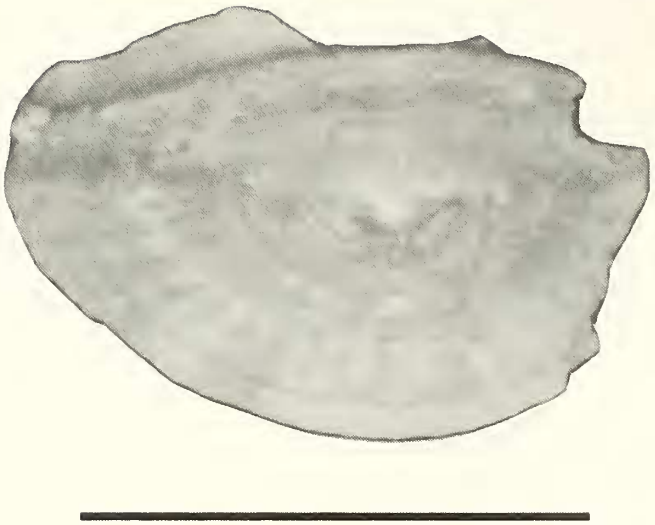

Figure 5. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Tail valve, scale bar = 5 mm.

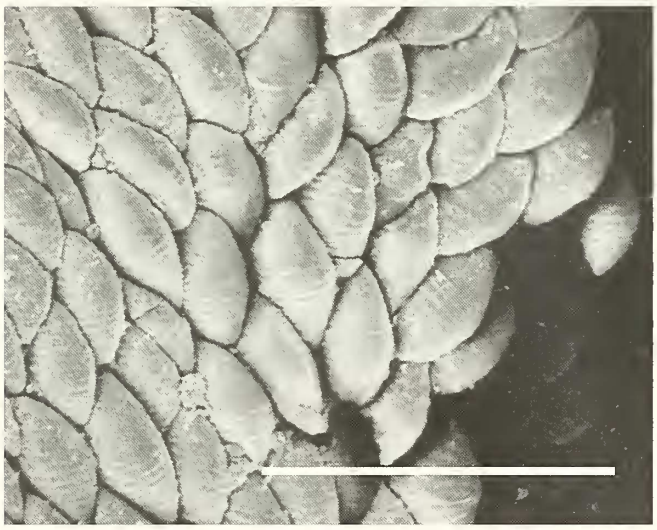

Figure 6. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Dorsal girdle scales, scale bar = 500 μm.

viewing stub; head and tail valves, and intermediate valve fragments separate, unmounted; body in ethanol (*leg.* Roger N. Clark, 28 September 1995; trawled R/V *Point Sur*).

Paratype (RNC 2060), whole animal in ethanol (*leg.* Roger N. Clark, 6 March 1997; trawled, R/V *Point Sur*).

Type locality: California, Monterey County, Monterey Submarine Canyon (36°45.163′N, 122°03.447′W), 650-700 m.

Habitat and ecology: The holotypes and paratypes were found living on large dead chunks of the massive, ridged, hexactinellid sponges *Aphrocallistes vastus* and *Heterochone calyx*. Another chiton, *Stenosemus stearnsii* was also found in this habitat.

Four additional chitons were found on rocks in the same trawls: *Tripoplax cowani* new species, *Placiphorella pacifica* Berry, 1919, *Leptochiton mesogonus* (Dall 1902), and *Leptochiton* sp.

Etymology: The name comes from Greek mythology, Calypso, the nymph who hid Ulysses.

Remarks: At first sight *Tripoplax calypso* merely looks like a deep-water specimen of *Lepidozona retiporosa* (Fig. 8) it is only when examined under magnification that the unique sculpture of the valves becomes evident. Still it might be passed off as a form of the latter, or perhaps considered to be within the considerable range of variation attributed to *Lepidozona scrobiculata* [as *Lepidozona sinudentata* (Carpenter in Pilsbry, 1892), Ferreira 1978, Kaas and Van Belle 1987] (Fig. 9). Although the multiple slits in the intermediate valves (lacking in both of the previous species) and the very faint radial sculpture serve to distinguish it. Additionally, the girdle scales of *T. calypso* reach about 200 × 160 μm and have 15-16 weak riblets, while those of *L. retiporosa* reach only about 145 × 120 μm and have eight to ten riblets, and the scales of *L. scrobiculata* reach 185 × 130 μm and have 10-13 weak riblets. *Lepidozona golischi* (Berry, 1919) [*Lepidozona scabricostata* (Carpenter) of Ferreira 1978, Kaas and Van

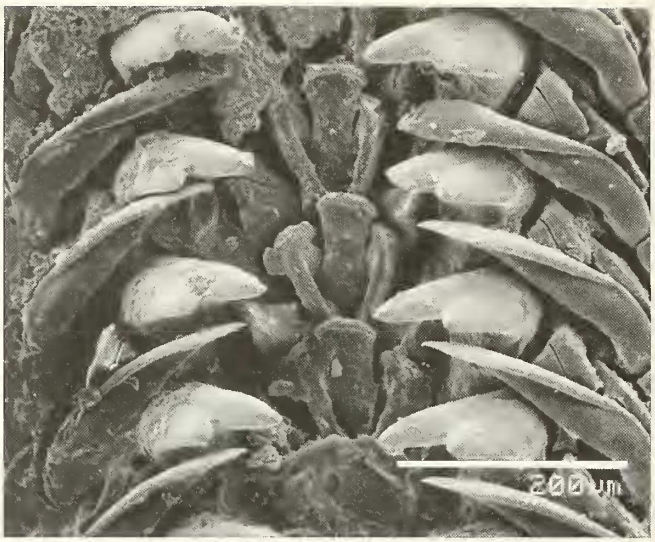

Figure 7. *Tripoplax calypso* Clark, spec. nov. Holotype (LACM 2882). Radula, scale bar = 200 μm.

Figure 8. *Lepidozona retiporosa* (Carpenter 1864). Scale bar = 10 mm. Eernisse coll., San Juan Island, Washington, depth unknown.

Figure 9. *Lepidozona scrobiculata* (von Middendorff, 1847). (RNC 244). Monterey Bay, California, 15 m, scale bar = 10 mm.

Belle 1987, and Clark 1991, non *L. scabricostata* (Carpenter, 1864)] (Fig. 10) might also be confused with this species but is generally uniformly pale orange, tan, or white in color; central areas are ribbed, radial areas are rather flat, sometimes with sulci, and bear relatively large, often scattered pustules and differently proportioned girdle scales reaching 130 × 220 μm and bearing 15-16 riblets.

Tripoplax cowani spec. nov. (Figs. 11-14)

Ischnochiton abyssicola Smith and Cowan, 1966 (in part)

Diagnosis

Medium sized (to 4.5 cm) oval chitons; valves solid, carinated, moderately elevated; terminal and lateral areas with radiating rows of oval pustules; central areas with longitudinal riblets; girdle narrow, less than one sixth the width of intermediate valve five; dorsal surface clothed with small, blunt, smooth, rounded, subtriangular scales, to 300 × 275 μm. Color: white, often stained yellowish or black with deep sea mineral deposits.

Description

Holotype (Fig. 11) of medium size (38 × 22.5 × 8 mm), oval, moderately elevated; valves granular, carinated, un-

Figure 10. *Lepidozona golischi* (Berry, 1919). (RNC 616). Cape Blanco, Oregon, 34 m, scale bar = 10 mm.

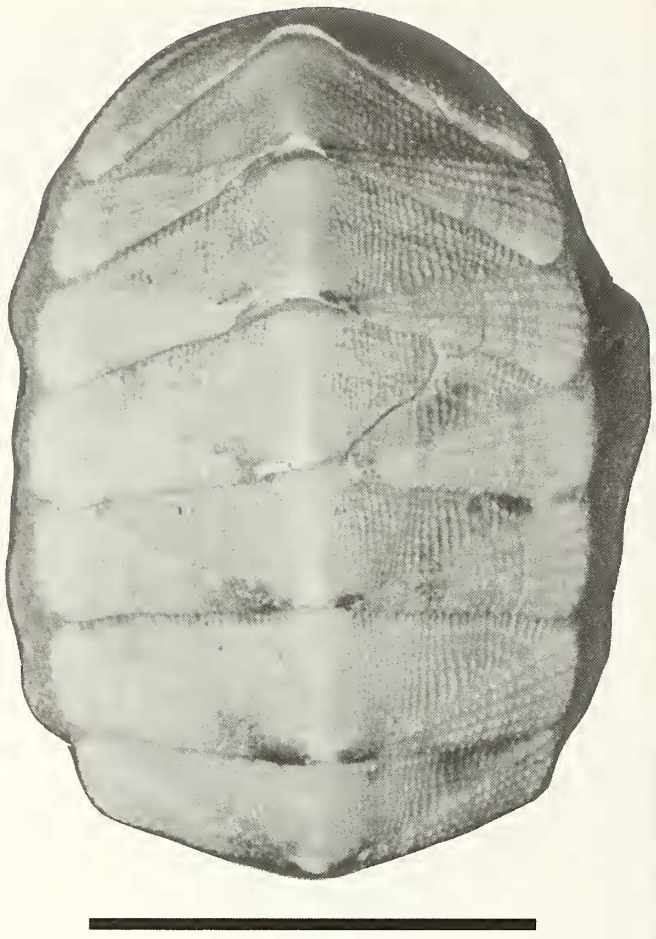

Figure 11. *Tripoplax cowani* Clark, spec. nov. Holotype (CASIZ 115832). Scale bar = 10 mm.

beaked, slopes straight to convex; tegmentum strongly sculptured. Head valve (Fig. 12) semi-circular, slope straight; posterior margin widely V-shaped, posterior edge slightly rounded; surface with 52 low, weak radiating ribs, capped with a row of oval pustules, and separated by faint sulci; intermediate valves (Fig. 13, valve V) oblong, about three times as wide as long, eaves short; lateral areas with six to eight radiating pustulose ribs, like those of the head valve; central areas with about 36 longitudinal riblets (18 per side), becoming obsolete at the jugum; jugum obsoletely pitted. Tail valve (Fig. 14) slightly convex anteriorly, rounded posteriorly, mucro ante-central, post-mucronal slope concave; ante-mucronal area with 32 longitudinal riblets (obsolete at jugum) post-mucronal area with about 43 radiating rows of pustules. Articulamnetum white, insertion teeth short, blunt; sutural laminae short, rounded connected across the moderate jugal sinus by a short, concave jugal plate with slits at edges; slit formula 16/1-3/14. Girdle (Fig. 15), narrow, about one sixth as wide as valves; dorsal surface covered with crowded, juxtaposed, smooth, blunt, rounded (subtriangular) scales to about 300 × 275 μm; margin of girdle with pointed spicules to about 250 × 20 μm; ventral surface covered with radiating rows of minute, rectangular scales 200 × 25 μm. Radula (Fig. 16) 13.5 mm long, bearing 43 mature rows of teeth; rachidean tooth about 150 μm long, broadly dilated anteriorly, working edge about 100 μm wide; minor laterals with small, anterolateral projection; major laterals large, with bidentate denticle cap, inner cusp twice as long as outer cusp. Ctenidia holobrachial, adanal, extending from beneath suture of head and second valves, to under tail valve, about 35 per side. Color: White, often stained with yellowish or black deep sea mineral deposits.

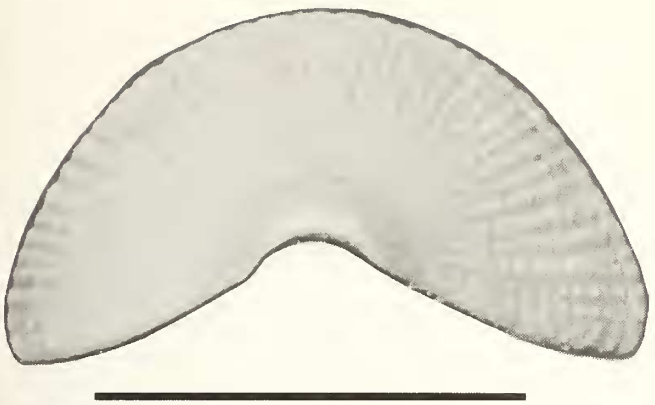

Figure 12. *Tripoplax cowani* Clark, spec. nov. Paratype (Clark 404). Head valve, scale bar = 10 mm.

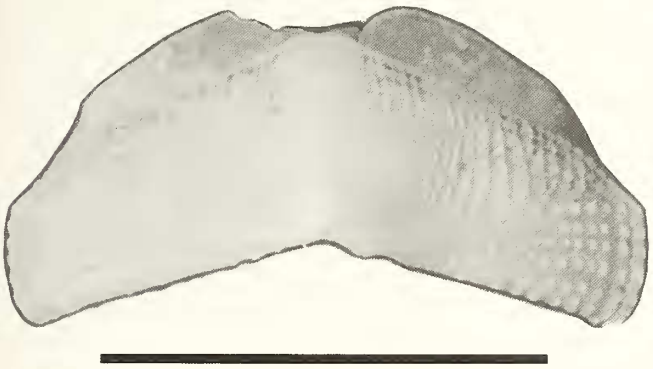

Figure 13. *Tripoplax cowani* Clark, spec. nov. Paratype (Clark 404). Intermediate valve V, scale bar = 10 mm.

Paratypes agree with the holotype in all aspects, except for variations in the number of radial ribs, and the number of slits in the articulamentum, due to the size and age of the specimens. The number of ribs on the head valves varies from 42-71, those of the lateral areas, from five to nine, and those on the tail valve from 32 to 43, slit formula range is 14-17/2-3/13-15. Paratypes range in size from 26.5 mm (LACM 2883) to ca. 45 mm (CASIZ 001640).

Type material

Holotype, CASIZ 11583, whole animal (curled) in alcohol, radula mounted on SEM stub (*leg.* USNS *DE Steiguer* 1975); Paratypes, 2, CASIZ 010602 (same data as holotype); 1, RNC 404 (same data as holotype); 1, LACM 2883; 1, ZIAS 1936; 2, RNC 2065 (*leg.* Chris Mah, 22 October 1994; trawled, R/V *Point Sur*, 650-700 m); 2, RNC 2121, west of San Francisco Bay, California (37°37.464′N, 123°05.43′W) (*leg.* R. N. Clark, 8 November 2000; trawled R/V *Miller Freeman*, 651-674 m; NMFS 21-0012-212).

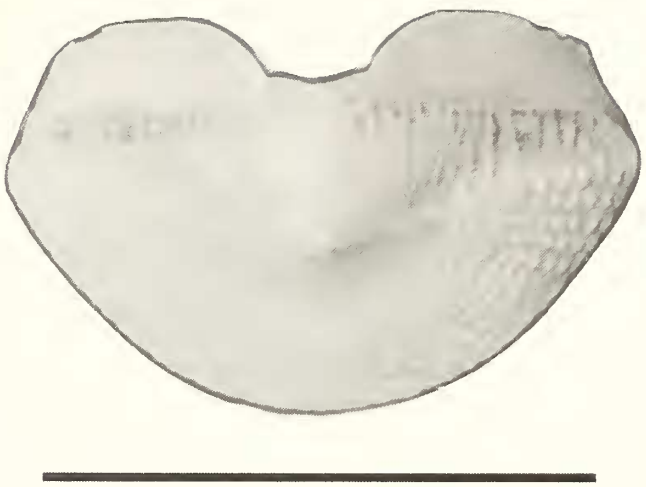

Figure 14. *Tripoplax cowani* Clark, spec. nov. Paratype (Clark 404). Tail valve, scale bar = 10 mm.

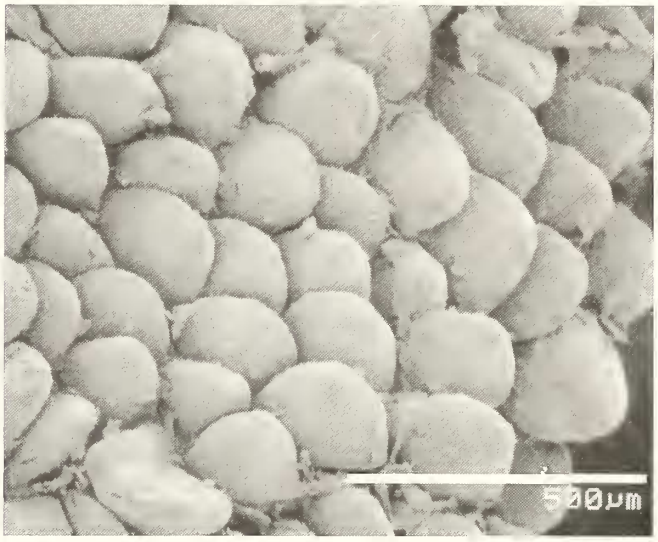

Figure 15. *Tripoplax cowani* Clark, spec. nov. Paratype (Clark 404). Dorsal girdle scales, scale bar = 500 µm.

Type locality

California, Monterey County, Carmel submarine canyon (36°45.3′N, 122°04.7′W), 954-1044 m.

Additional material

2, CASIZ 103675 and 025503, off Trinidad, Humboldt County, California (41°05′N) (*leg.* R. Talmadge, 1972; trawled, 432-720 m); 1, CASIZ 0198513 Swiftsure Bank, Washington (*leg.* I. McTaggart Cowan and D. B. Quayle, 6 September 1964; trawled, 975 m) (Paratype of *Ischnochiton*

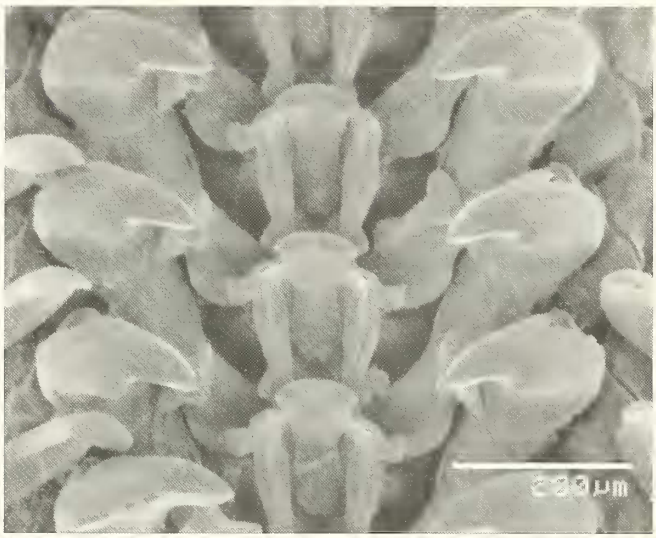

Figure 16. *Tripoplax cowani* Clark, spec. nov. Paratype (Clark 404). Radula, scale bar = 200 μm.

abyssicola Smith and Cowan, 1966); 4, RNC 2108, off Del Norte County, California (41°41.962′N, 125°00.732′W) (*leg.* R. N. Clark, 23 October 2001; trawled R/V *Miller Freeman*, 855 m; NMFS 21-0112-106).

Distribution

Tripoplax cowani has been collected from the Swiftsure Bank, Washington (48°30′N) to the type locality, Carmel Bay, California (36°45′N) at depths of 432-1044 m.

Habitat

Juveniles have been found on gravel (Smith and Cowan 1966, as *Ischnochiton abyssicola*); adults are found on large rocks and boulders.

Etymology

It is with great pleasure that I name this species after my friend and colleague, Dr. Ian McTaggart Cowan, of Victoria, British Columbia, Canada.

Remarks

The similarities between *Tripoplax cowani* and *Tripoplax abyssicola* (Figs. 17-19) in form, color, and sculpturing of the valves are remarkable, and explain why the present species has hitherto gone unrecognized. However, despite the similarities in general appearance, the two species may be readily distinguished by:

(1) Body outline, *T. cowani* is much broader than *T. abyssicola*, length 1.7 times width, compared to 2.3 in *T. abyssicola*.

Figure 17. *Tripoplax abyssicola* Smith and Cowan, 1966. Holotype. Triangle Island, British Columbia, Canada, 870 m, scale bar = 10 mm.

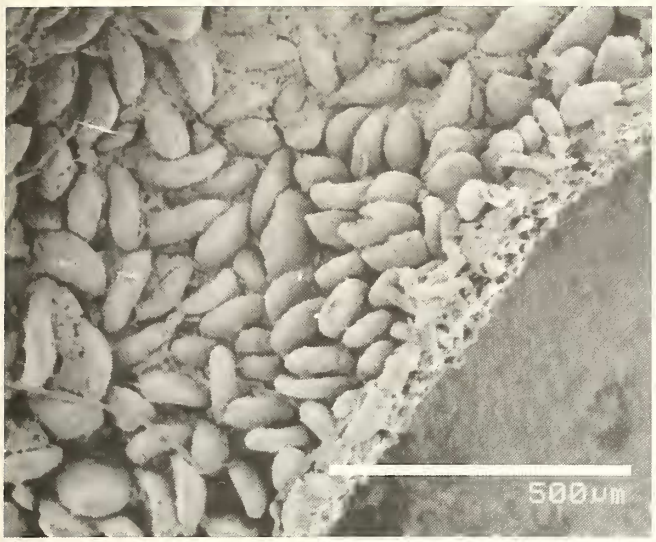

Figure 18. *Tripoplax abyssicola* Smith and Cowan, 1966. Paratype (Cowan coll., No. 5538). Triangle Island, British Columbia, 870 m, dorsal girdle scales, scale bar = 500 µm.

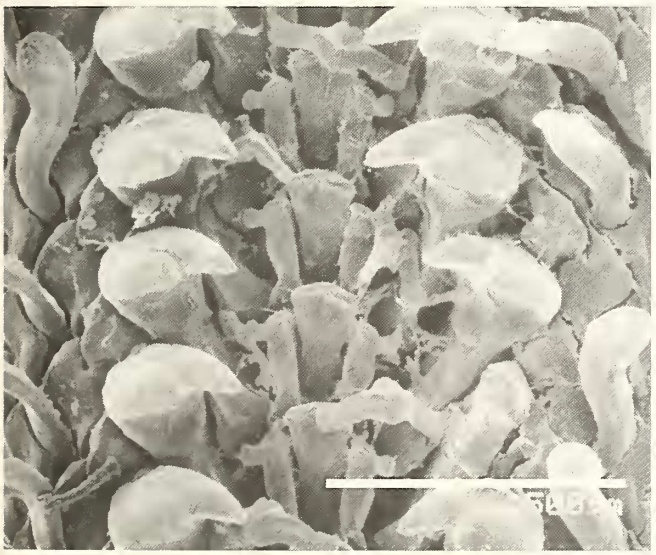

Figure 19. *Tripoplax abyssicola* Smith and Cowan, 1966; (RNC 2106, ex RNC 3106). Farallon Islands, California, 2750 m, radula, scale bar = 500 µm.

(2) Tegmental sculpturing, in animals of approx. the same size, *T. cowani* exhibits fewer and coarser radial ribs (or rows of pustules/granules). A comparison of the largest paratype of *T. cowani* (ca. 45 mm) with the holotype of *T. abyssicola* (46 mm) illustrates this well. The head valve of the *T. cowani* paratype has 70 ribs, compared to 85 in the holotype of *T. abyssicola*. The lateral areas of *T. cowani* have five to nine ribs, compared to 11-13 in *T. abyssicola*. The tail valve of *T. cowani* has 40 ribs, the tail valve of *T. abyssicola* has 65 ribs.

(3) The relative sizes of the pustules/granules on the radial ribs are quite distinct also, in animals of about the same size (45-46 mm), the pustules of *T. cowani* are 200-300 µm at about midpoint of the riblets, and form a series of about 18-19 on the lateral areas. Those of *T. abyssicola* are 100-150 µm and form a series of 28-30 on the lateral areas.

(4) Fewer, coarser riblets on central areas, 40-42 on *T. cowani*, and ≥60 on *T. abyssicola*.

(5) The dorsal girdle scales of *T. cowani* are relatively large and subtriangular in shape, reaching about 300 × 275 µm, those of *T. abyssicola* (Fig. 18) are much smaller and narrower, to about 200 × 125 µm, and are slightly curved at the tip, like diminutive surf boards.

(6) *Tripoplax cowani* has fewer ctenidia than *T. abyssicola*, 31 in a specimen 28 mm in length, compared to 37 in a 22 mm *T. abyssicola*, 36 compared to 41 in specimens 41 mm in length, and 37 for *T. cowani* and 43 for *T. abyssicola*, respectively in specimens 45 mm in length.

The geographic and bathymetric ranges of *Tripoplax cowani* and *Tripoplax abyssicola* overlap somewhat from northern California to Washington; however, *T. cowani* is generally found much shallower than *T. abyssicola*, 430-1050 m compared to 950-2750 m. *Tripoplax abyssicola* also has a much broader geographic range than *T. cowani*, extending from the western Aleutian Islands, south of Amchitka Island (51°34.14′N, 178°18.49′E) (RNC 2166; *leg.* R. Clark, 16 July 2004, trawled R/V *Sea Storm*, 478 m) to near the Farallon Islands, west of San Francisco Bay, California (38°N; RNC 2106). Range here is extended approx. 900 km west from southwest of Unalaska Island (52°36′N, 169°25′W); CASIZ 129748 (Clark 2000). The range of *T. cowani* extends from the Swiftsure Bank, off Washington (48°30′N) to Carmel Bay, California (36°45′N).

Tripoplax cowani might also be confused with *Stenosemus stearnsii* (Dall, 1902) (Fig. 20), which is smaller (to 25 mm in length) and similar in general appearance, but has broad, low, somewhat flattened, cobble-stone like sculpture on the radial areas and large, subcylindrical, curved corpuscles to 430 × 160 µm. *Stenosemus stearnsii* is found from off Clatsop County, Oregon (45°50′N) to near San Clemente Island, California (33°N) (Clark 1991), at depths of 400-700 m.

The additions of *Tripoplax cowani* and *Tripoplax calypso*, along with *Tripoplax trifida* (Carpenter, 1864), *Tripo-*

Figure 20. *Stenosemus stearnsii* (Dall, 1902). (RNC, 1583). Monterey Sea Canyon, 650 m, scale bar = 10 mm.

plax abyssicola (Smith and Cowan, 1966), *Tripoplax ima* (Sirenko, 1975), *Tripoplax allyni* (Ferreira, 1977), *Tripoplax attuensis* (Clark, 2000), *Tripoplax beringiana* (Clark, 2000) and *Tripoplax baxteri* (Clark, 2000) brings the number of known species of *Tripoplax* along the Pacific coast of North America to nine. The similar appearing *Ischnochiton regularis* (Carpenter, 1855) from northern California appears to be genetically distinct at the genus level (D. Eernisse, pers. comm., September 2007).

ACKNOWLEDGMENTS

I am grateful to the following people for their help in the preparation of this paper: Elizabeth Kools and Robert Van Syoc, CAS; James H. McLean and Lindsey Groves, LACM; Boris I. Sirenko, ZIAS; Darlene Southworth, Southern Oregon University; Philip Lambert, Royal British Columbia Museum; Douglas J. Eernisse, California State University, Fullerton; and Chris Mah, USNM, for the gift of several specimens from his 1994 cruise on the R/V *Point Sur*. The comments of two reviewers are also greatly appreciated.

LITERATURE CITED

Berry, S. S. 1919. Notes on West American chitons II. *Proceedings of the California Academy of Sciences* **9**: 1-36.

Clark, R. N. 1991. Notes on the distribution, taxonomy and natural history of some North Pacific chitons. *The Veliger* **34**: 91-96.

Clark, R. N. 2000. Three new chitons of the genus *Lepidozona* Pilsbry, 1892 (Polyplacophora: Ischnochitonidae) from the Aleutian Islands. *Nemouria, Occasional Papers of the Delaware Museum of Natural History* **42**: 1-16.

Dall, W. H. 1871. Descriptions of sixty new forms of mollusks from the west coast of North America and the North Pacific Ocean, with notes on others already described. *American Journal of Conchology* **7**: 93-160.

Ferreira, A. J. 1978. The genus *Lepidozona* (Mollusc: Polyplacophora) in the temperate eastern Pacific, Baja California to Alaska, with the description of a new species. *The Veliger* **21**: 19-44.

Kaas, P. and R. A. Van Belle. 1985. *Monograph of Living Chitons (Mollusca: Polyplacophora). Vol. 3, Suborder Ischnochitonina, Ischnochitonidae: Chaetopleurinae, & Ischnochitoninae* (part). E. J. Brill/Dr. W. Backhuys, Leiden, The Netherlands.

Kaas, P. and R. A. Van Belle. 1987. *Monograph of Living Chitons (Mollusca: Polyplacophora). Vol. 4, Suborder Ischnochitonina, Ischnochitonidae: Ischnochitoninae* (continued). E. Brill, Leiden, The Netherlands.

Kaas, P. and R. A. Van Belle. 1990. *Monograph of Living Chitons (Mollusca: Polyplacophora). Vol. 5, Suborder Ischnochitonina, Ischnochitonidae: Ischnochitoninae (concluded) Callistoplacinae; Mopaliidae*. E. J. Brill, Leiden, The Netherlands.

Palmer, K. E. H. V. W. 1958. Type specimens of marine Mollusca described by P. P. Carpenter from the west coast (San Diego to British Columbia). *Geological Society of America, Memoirs* **76**: 1-376.

Smith, A. G. and I. McTaggart Cowan. 1966. A new deep-water chiton from the Northeastern Pacific. *Occasional Papers of the California Academy of Sciences* **56**: 1-15.

Submitted: 29 March 2007; **accepted:** 9 November 2007; **final revisions received:** 26 February 2008